Electronic Version
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Claims

[c1] A motor switch cell comprising:
a switch cell actuator slidably engaged to a switch cell base, said switch cell actuator slidable between a neutral actuator position and a first active actuator position;
a first neutral contact element positioned within said switch cell base;
a first active contact element positioned within said switch cell base;
a first contactor element positioned within said switch cell base, said first contactor element rotatable between a neutral first contactor position and an active first contactor position, said first contactor element including an upper first contactor edge and a lower first contactor edge, said first contactor element generating electrical communication between said first neutral contact element and said first active contact element when in said active first contactor position;
a first contactor ramp profile formed on said upper first contactor edge, said first contactor ramp profile including a first contactor neutral center point and a first contactor active outer edge, said first contactor active outer edge positioned closer to said switch cell actuator than

said first contactor neutral center point;

a first contactor pivot positioned between said first contactor neutral center point and said first active contact; and

a first roller cam follower assembly mounted to said switch cell actuator, said first roller cam follower assembly including a first roller engagement tip rotatably engaging said first contactor ramp profile, said first roller cam follower assembly rotating said first contactor element from said neutral first contactor position to said active first contactor position as said first roller cam follower assembly moves from said first contactor neutral center point towards said first contactor active outer edge in response to said switch cell actuator moving to said first active actuator position.

[c2] A motor switch cell as described in claim 1, wherein said first roller engagement tip comprises a ball bearing.

[c3] A motor switch cell as described in claim 1, wherein said first roller cam follower assembly comprises:

a cage element mounted to said switch cell actuator, said cage element positioned between said switch cell actuator and said first contactor element;

a ball bearing protruding from said cage element, said ball bearing protruding from said cage element to engage said first contactor ramp profile; and

a spring element positioned within said cage element between said ball bearing and said switch cell actuator, said spring element holding said ball bearing in contact with said first contactor ramp profile.

[c4] A motor switch cell as described in claim 1, wherein said first contactor pivot comprises:
a pivot arch having a flat pivot surface formed in said lower first contactor edge of said first contactor element, said first neutral contact element positioned within said pivot arch.

[c5] A motor switch cell as described in claim 1, further comprising:
a neutral conductive contact positioned within said switch cell base, said first contactor element placing said neutral conductive contact in electrical communication with said first neutral contact when said first contactor element is in said neutral first contactor position.

[c6] A motor switch cell as described in claim 1, wherein said first contactor element includes a symmetrical axis through said first contactor neutral center point.

[c7] A motor switch cell as described in claim 1, wherein said first contactor element comprises a vertically orientated flat plate.

[c8] A motor switch cell as described in claim 1, further comprising:
a curved profile portion formed on said first contactor ramp profile, said curved profile portion positioned adjacent said first contactor active outer edge, said curved profile portion increasing a ramp profile slope.

[c9] A motor switch cell as described in claim 1, further comprising:
a center of gravity extension formed on said lower first contactor edge, said center of gravity extension biasing said first contactor element to a vertical orientation.

[c10] A motor switch cell as described in claim 1, further comprising:
at least one alignment extension formed on said lower first contactor edge, said at least one alignment extension securing said first contactor element within said switch cell base during assembly.

[c11] A motor switch cell as described in claim 10, further comprising:
at least one alignment notch formed in said switch cell base, said at least one alignment notch positioned to engage said at least one alignment extension during assembly to minimize movement of said first contactor el-

ement.

[c12] A motor switch cell as described in claim 9, wherein said center of gravity extension engages said first neutral contact element and stops said first contactor element when said first contactor element is moved into said active first contactor position.

[c13] A motor switch cell as described in claim 1, further comprising:
a second neutral contact element positioned within said switch cell base;
a second active contact element positioned within said switch cell base;
a second contactor element positioned within said switch cell base, said second contactor element rotatable between a neutral second contactor position and an active second contactor position, said second contactor element including an upper second contactor edge and a lower second contactor edge, said second contactor element generating electrical communication between said second neutral contact element and said second active contact element when in said active second contactor position;
a second contactor ramp profile formed on said upper second contactor edge, said second contactor ramp profile including a second contactor neutral center point and

a second contactor active outer edge, said second contactor active outer edge positioned closer to said switch cell actuator than said second contactor neutral center point;

a second contactor pivot positioned between said second contactor neutral center point and said second active contact; and

a second roller cam follower assembly mounted to said switch cell actuator, said second roller cam follower assembly including a second roller engagement tip rotatably engaging said second contactor ramp profile, said second roller cam follower assembly rotating said second contactor element from said neutral second contactor position to said active second contactor position as said second roller cam follower assembly moves from said second contactor neutral center point towards said second contactor active outer edge in response to said switch cell actuator moving to a second active actuator position, said neutral actuator position positioned between said first active actuator position and said second active actuator position.

[c14] A motor switch cell comprising:

a switch cell actuator slidably engaged to a switch cell base, said switch cell actuator slidable between a neutral actuator position and a first active actuator position;

a first neutral contact element positioned within said switch cell base;

a first active contact element positioned within said switch cell base;

a first contactor element positioned within said switch cell base, said first contactor element rotatable between a neutral first contactor position and an active first contactor position, said first contactor element including an upper first contactor edge and a lower first contactor edge, said first contactor element generating electrical communication between said first neutral contact element and said first active contact element when in said active first contactor position;

a first contactor ramp profile formed on said upper first contactor edge, said first contactor ramp profile including a first contactor neutral center point and a first contactor active outer edge, said first contactor active outer edge positioned closer to said switch cell actuator than said first contactor neutral center point;

a pivot arch formed in said lower first contactor edge of said first contactor element, said first neutral contact element positioned within said pivot arch to form a first contactor pivot, said first contactor pivot positioned between said first contactor neutral center point and said first active contact; and

a first roller cam follower assembly mounted to said

switch cell actuator, said first roller cam follower assembly including a ball bearing rotatably engaging said first contactor ramp profile such that said roller cam follower assembly exerts a normal force on said first contactor ramp profile, said ball bearing rotating said first contactor element from said neutral first contactor position to said active first contactor position as said first roller cam follower assembly moves from said first contactor neutral center point towards said first contactor active outer edge in response to said switch cell actuator moving to said first active actuator position.

[c15] A motor switch cell as described in claim 14, further comprising:
a neutral conductive contact positioned within said switch cell base, said first contactor element placing said neutral conductive contact in electrical communication with said first neutral contact when said first contactor element is in said neutral first contactor position.

[c16] A motor switch cell as described in claim 14, further comprising:
a curved profile portion formed on said first contactor ramp profile, said curved profile portion positioned adjacent said first contactor active outer edge, said curved profile portion increasing a ramp profile slope.

[c17] A multiple direction switch assembly comprising:
a lower main housing;
an upper main housing;
a switch cell circuit assembly positioned between said lower main housing and said upper main housing, said switch cell circuit assembly including a plurality of switch cells, each of said plurality of switch cells comprising:
a switch cell actuator slidably engaged to a switch cell base, said switch cell actuator slidable between a neutral actuator position and a first active actuator position;
an actuator tower formed on said switch cell actuator;
a first neutral contact element positioned within said switch cell base;
a first active contact element positioned within said switch cell base;
a first contactor element positioned within said switch cell base, said first contactor element rotatable between a neutral first contactor position and an active first contactor position, said first contactor element including an upper first contactor edge and a lower first contactor edge, said first contactor element generating electrical communication between said first neutral contact element and said first active contact element when in said active first contactor position;
a first contactor ramp profile formed on said upper first contactor edge, said first contactor ramp profile includ-

ing a first contactor neutral center point and a first contactor active outer edge; and

a first roller cam follower assembly mounted to said switch cell actuator, said first roller cam follower assembly rotatably engaging said first contactor ramp profile, said first roller cam follower assembly rotating said first contactor element from said neutral first contactor position to said active first contactor position as said first roller cam follower assembly moves from said first contactor neutral center point towards said first contactor active outer edge in response to said switch cell actuator moving to said first active actuator position; and

a plurality of cell engagement slots formed in an upper main housing surface, each of said plurality of cell engagement slots corresponding to one of said actuator towers, each of said actuator towers extending through one of said plurality of engagement slots;

an engagement plate in communication with said actuator towers, said engagement plate in communication with a single interface button; and

a guide plate positioned between said engagement plate and said single interface button;

wherein said single interface button provides actuation control over said plurality of switch cells.

[c18] A multiple direction switch assembly as described in

claim 18, further comprising:
two pillar elements mounted to said engagement plate, said two pillar elements providing communication between said engagement plate and said single interface button; and
two four-way directional slots formed in said guide plate, each of said two pillar elements passing through one of said two four-way directional slots.

[c19] A multiple direction switch assembly as described in claim 18, further comprising:
an anti-rattle element positioned between said engagement plate and said upper main housing.

[c20] A multiple direction switch assembly as described in claim 18, wherein said plurality of switch cells comprises:
a first outer switch cell orientated perpendicular to a single interface button longitudinal centerline;
a second outer switch cell orientated perpendicular to said single interface button longitudinal centerline; and
a center switch cell orientated parallel to said single interface button longitudinal centerline, said center switch cell positioned between said first outer switch cell and said second outer switch cell.